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UNRAVELING THE RELATIONSHIP: STATISTICAL RESEARCH ON THE INTERSECTION OF TECHNOLOGY AND ENTREPRENEURSHIP FOR MODERN PRACTICES, POLICIES, AND PROMISES

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Abstract

The intersection of technology and entrepreneurship has been a catalyst for advancements and prosperity in individuals, firms, regions, and nations. However, a comprehensive statistical study and understanding of the interface of variables concerning this intersection is still lacking. This paper aims to shed light on the pivotal point of intersection between entrepreneurship and technology, exploring emerging policies, promises, and practices. Through the use of questionnaires, 32 variables were identified and administered to knowledgeable respondents in this field. While previous research has explored the relationship between technology and entrepreneurship, a comprehensive analysis of the nexus between these key elements of national growth and development is necessary. Entrepreneurship, defined as the discovery, evaluation, and exploitation of opportunities to produce future goods and services, relies on technology as a crucial component. Scholars view entrepreneurship as particularly important in later stages of economic development, were knowledge and competition drive growth. However, at earlier stages, entrepreneurship may play a less pronounced role due to the predominance of factor accumulation. Not all entrepreneurs drive development, and not all entrepreneurs are innovative, highlighting the need for a deeper understanding of the relationship between entrepreneurship and economic outcomes. In order to uncover the intercorrelation among the identified factors related to technology and entrepreneurship, this study employs Principal Component Analysis (PCA). PCA is a mathematical procedure that reduces a larger number of variables to a smaller number of uncorrelated principal components, allowing for dimensionality

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reduction and data compression. By identifying the key factors and examining their interrelationships, this research aims to provide insights into the intersection between technology and entrepreneurship

1. INTRODUCTION

Advances in entrepreneurship breakthroughs have undoubtedly been made possible through the use of technology. Similarly, intersection of technology in entrepreneurship is a vehicle that facilitates prosperity in individuals, firms, regions and nations. This study therefore serves an important function beyond satisfying intellectual curiosity. A lot of factors or variables arise from the point of the intersection. It is important that these factors are known and studied. Several journals were consulted in the course of crafting the set of questionnaires where 32 variables were obtained and administered to knowledgeable respondents in this area of study. A lot of researchers have tried to know the relationship between technology and entrepreneurship. Such researches include [1]-[2]. Knowledge and application of technology is prevalent. Yet, a comprehensive statistical study and understanding of the interface of variables concerning it is still lacking. It is important to know the nexus between these key elements of national growth and development. The main objective of this paper is hence to shed light and establish the pivotal point of intersection between entrepreneurship and technology as for emerging policies, promises and practices. Entrepreneurship has been defined and explained by many authors. More recently, the research field of entrepreneurship has been defined as analysis of "how, by whom and with what consequences opportunities to produce future goods and services are discovered, evaluated and exploited" [6]. As regards "how", it depicts the technology to be used by the entrepreneur. Closer scrutiny of the relationship between entrepreneurship and economic development is therefore needed. In order to stimulate the development-entrepreneurship discourse it may be necessary to first attempt to formalize or reconcile the role of entrepreneurship in the "grand ideas" of development economics, and to consider how this resonates with available evidence, and what this means for policy. [5], famously defined the entrepreneur as the coordinator of production and agent of change ('creative destruction'). As such the "Schumpeterian" entrepreneur is above else an innovator. Scholars who share this view of entrepreneurship do not consider entrepreneurship to be very important in earlier stages of economic development – they see the contribution of entrepreneurship to be much more important at later stages of development, where economic growth is driven by knowledge and competition. At earlier stages of development, entrepreneurship may play a less pronounced role because growth is largely driven by factor accumulation [4].
Opportunity-motivated entrepreneurship may contribute to a nation's happiness, but only up to a point. Not everybody should become entrepreneurs, and the happiness of a nation cannot be –indefinitely increased by increasing the numbers of entrepreneurs [3].
[7]. Consider the literature on the impact of entrepreneurship on employment, innovation and productivity growth. They find that entrepreneurs do not spend more on R&D than their counterparts, although the quality and efficiency of their innovation is higher, and that their contribution to productivity growth is low. The majority of entrepreneurs would earn higher incomes as wage employees, and while entrepreneurs create more jobs relative to non-entrepreneurs, the quality of jobs they create is lower. Hence not all entrepreneurs drive development, and not all entrepreneurs are innovative [6].
Principal component analysis (PCA) is a mathematical procedure that transforms a number of (possibly) correlated variables into a (smaller) number of uncorrelated variables called principal components. The first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible.PCA reduces attribute space from a larger number of variables to a smaller number of factors and as such is a "nondependent". PCA is a dimensionality reduction or data compression method. The goal is dimension reduction. The aim of this paper is to identify a number of factors that deal with technology and entrepreneurship with a view to understanding the intercorrelation among the identified factors thereby making us to know the intersection between them.

2. METHODOLOGY

Kendall's Coefficient of Concordance (KCC)

32 identified scale items were identified from the literature reviewed in this area. This was then used to craft questionnaires that were administered to knowledgeable respondents in the area of entrepreneurship and technology. The scale items were administered to thirteen selected judges who ranked the first set of questionnaire in descending order of importance. The result of the respondents was used to generate a data matrix having a dimension of 13 by 32.The measure of agreement among the judges who ranked the scale items was computed. The consistency in ranking is represented by Kendall's coefficient of concordance. Chi square ($\chi 2$) was used to appraise the judges consistency in ranking the scale items. The Chi-square test, laid on a null hypothesis (H_0) proposes that the ranking by the 13 judges are discordant while the alternate hypothesis (H_1) proposes that the 13 judges were consistent. The null hypothesis was rejected at p-value of 0.05. Kendall coefficient of concordance W,

$$W = \frac{S}{\frac{1}{12} K^2 (N^3 - N)} \quad (1)$$

Where,

$$S = \sum (R_j - \overline{NR_j})^2$$

R_j = Column sum of ranks
N = Total number of Variables
S = Variance
K = Number of Judges

Principal Component Analysis

The second set of questionnaires that also contains 32critical variables was administered to other set of (100) respondents (Judges) for their expert evaluations. Respondent's scores were collated as data matrix and fed into StatisticXL software that provided the following output namely: descriptive Statistic, correlation matrix, eigenvalues, eigenvector, unrotated factor loading, case-wise factor scores, varimax rotated factor loadings, explained variance and factor plot, among others. On the basis of this statistiXL output, factor matrix interpretation was given and results discussed.

From the data matrix the correlation matrix was obtained using Equation (2) as stated below;

$$r_{ij} = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} \quad (2)$$

where, $x = X_{ij} - \overline{X}_{.j}$

$$y = Y_{ij} - \overline{Y}_{.j}$$

$$\overline{X}_{.j} = \frac{\sum_{i=1}^{N} X_{ij}}{N}$$

$$\overline{Y}_{.j} = \frac{\sum_{i=1}^{N} Y_{ij}}{N}$$

N

$N \square n_j \square I \square i_{\max}$

$J \square j_{\max}$

3. RESULT AND DISCUSSION

Result of Kendall Coefficient of concordance (KCC)

S/N	Ranking Rj	Variables description	S/N	Ranking Rj	Variables description
1	13	Innovation	17	231	Brainstorming
2	36	Invention	18	251	Creation of New Market
3	96	Technical Skills	19	255	Entrepreneurship as heffalump
4	108	Research and Development	20	260	Policy formulation
5	113	Technology Village	21	264	Intellectual property
6	147	Curriculum review	22	267	Use of Patent
7	153	Opportunity Recognition	23	276	Apoliticism
8	155	Information Technology	24	291	Knowledge diffusion
9	155	Risk taking	25	298	Level of economic development
10	166	Incentives	26	301	Interdependence of technology
11	167	Need for Achievement	27	306	Push and Pull Factors
12	175	Uncertainty	28	316	Taxes and Entry
13	182	Knowledge filter	29	324	Theoretical framework
14	198	Serendipity	30	344	High transaction cost
15	209	Entrepreneurship spirit	31	344	Importationitis
16	227	Management of Technology	32	686	Entrepreneurship Workshop

Table 1

Our results show that since $x_{cal}^2 = 306.376 > x_{tab}^2 = 82.1914$, our experimental data do not provide sufficient proof for us to accept a null hypothesis of discordance among the judges who did the ranking. Thus the null hypothesis, Ho was rejected at a p-value of 0.05, implying therefore that the judges ranking were in concordance, W = 0.898570 (which is meritorious).

Result of Principal Component Analysis (PCA)

The thirty two variables were developed into questionnaire and presented to 109 respondents where only 100 responses were retrieved.The data obtained from the questionnaire were arranged in matrix form based on the 5–point Resis-Likert scale.

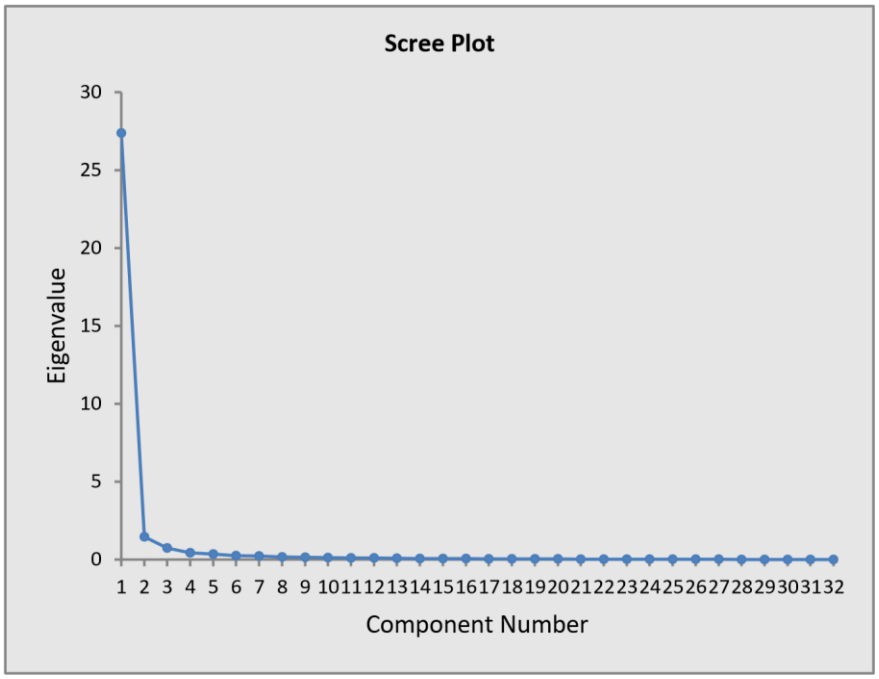

Fig. 1 Scree Plot

Varimax Rotated Factor Loadings matrix of 32 variables of Intersection between Entrepreneurship and Technology						
S/N	**Variable**	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
1.	**Innovation**	0.516	0.385	0.316	**0.954**	0.097
2.	**Invention**	**0.815**	0.463	0.228	0.057	0.103
3.	**Technical Skills**	0.452	**0.776**	0.255	0.236	0.134
4.	**Research and Development**	**0.554**	0.437	0.380	0.266	0.333
5.	**Technology Village**	0.530	**0.742**	0.207	0.137	0.126
6.	**Curriculum review**	0.540	**0.824**	0.300	0.142	0.067
7.	**Opportunity Recognition**	**0.811**	0.465	0.208	0.150	0.144
8.	**Information Technology**	0.543	**0.737**	0.222	0.185	0.081
9.	**Risk taking**	**0.739**	0.376	0.245	0.359	0.033
10.	**Incentives**	**0.527**	**0.555**	0.458	0.193	0.181
11.	**Need for Achievement**	**0.730**	0.425	0.211	0.165	0.144
12.	**Uncertainty**	**0.723**	0.344	0.355	0.268	0.113
13.	**Knowledge filter**	0.405	**0.597**	**0.619**	0.223	0.114
14.	**Serendipity**	0.382	**0.795**	0.312	0.246	0.146
15.	**Entrepreneurship spirit**	0.411	**0.826**	0.260	0.107	0.121
16.	**Management of Technology**	**0.819**	0.433	0.215	0.192	0.109
17.	**Brainstorming**	**0.624**	**0.500**	0.361	0.093	**0.426**
18.	**Creation of New Market**	0.426	**0.667**	0.238	0.115	0.149
19.	**Entrepreneurship as heffalump**	**0.787**	0.480	0.270	0.105	0.134
20.	**Policy formulation**	**0.790**	0.498	0.233	0.101	0.078

21.	**Intellectual property**	**0.771**	0.384	0.264	0.263	0.244
22.	**Use of Patent**	0.506	**0.776**	0.212	0.157	0.089
23.	**Apoliticism**	0.461	**0.584**	**0.561**	0.233	0.123
24.	**Knowledge diffusion**	**0.592**	**0.469**	0.383	0.176	**0.468**
25.	**Level of economic development**	0.470	**0.786**	0.234	0.124	0.106
26.	**Interdependence of technology**	**0.783**	0.380	0.267	0.254	0.031
27.	**Push and Pull Factors**	0.312	**0.599**	**0.694**	0.176	0.105
28.	**Taxes and Entry**	0.395	**0.721**	0.334	0.165	0.174
29.	**Theoretical framework**	**0.667**	0.344	0.374	0.320	0.126
30.	**High transaction cost**	0.398	**0.710**	0.419	0.204	0.154
31.	**Importationitis**	0.418	**0.789**	0.297	0.232	0.133
32.	**Entrepreneurship Workshop**	**0.725**	**0.557**	0.182	0.165	0.022

Table 2 **Factor Interpretation;**

FACTOR 1: DOGMATIC PRINCIPLES.

Clusters 1(Factor 1): Dogmatic Princi ples.		
S/N	**Variable description**	**Factor loading**
2	**Invention**	**0.815**
4	**Research and Development**	**0.594**
7	**Opportunity Recognition**	**0.811**
9	**Risk taking**	**0.739**
10	**Incentives**	**0.527**
11	**Need for Achievement**	**0.830**
12	**Uncertainty**	**0.723**
16	**Management of Technology**	**0.819**
17	**Brainstorming**	**0.624**
19	**Entrepreneurship as heffalump**	**0.787**
20	**Policy formulation**	**0.790**
21	**Intellectual property**	**0.771**
24	**Knowledge diffusion**	**0.592**
26	**Interdependence of technology**	**0.783**
29	**Theoretical framework**	**0.667**
32	**Entrepreneurship Workshop**	**0.725**

Table 3

The PCA adopted with the aid of StatistiXL software, generated five (5) clusters or platoons. A principal factor embodying sixteen (16) variables which we creatively labelled;dogmatic principles. Seven (7) variables emerged top in the list on the basis of their high factor loadings; First on the list is Need for Achievement (N-Ach) wielding a factor loading of **0.830,** under this it can be said any individual without N-ach cannot be involved in technology entrepreneurship.

FACTOR 2: CONCEPTUAL FRAMEWORK.

Clusters 2(Factor 2): Conceptual Framework.		
S/N	**Variable description**	**Factor loading**
3	**Technical Skills**	**0.776**
5	**Technology Village**	**0.742**
6	**Curriculum review**	**0.724**
10	**Incentives**	**0.555**
13	**Knowledge filter**	**0.597**
14	**Serendipity**	**0.793**
15	**Entrepreneurship spirit**	**0.826**
17	**Brainstorming**	**0.500**
18	**Creation of New Market**	**0.607**
22	**Use of Patent**	**0.776**
23	**Apoliticism**	**0.584**
24	**Knowledge diffusion**	**0.469**
25	**Level of economic development**	**0.786**
27	**Push and Pull Factors**	**0.599**
28	**Taxes and Entry**	**0.721**
30	**High transaction cost**	**0710**
31	**Importationitis**	**0.789**
32	**Entrepreneurship Workshop**	**0.567**

Table 4

Management of Technology with factor loading **0.819**is very instructive. Management of Technology can be said to be a form of engineering economy as it depicts the real meaning as an interdisciplinary field integrating science, engineering and management knowledge and practice.MOT principles are not different from engineering economy as both have a central philosophy that focuses on creative thinking in design, research and development, engineering processes and so on in order to achieve improved output at minimum cost and reduced input. Invention with **0.815**factor loading is an event that produces a new idea, product, services, etc. Next is opportunity recognition with a factor loading of **0.811** which implies an individual being able to identify an opportunity and turn it into business. Cluster 2 is creatively labeled Conceptual Framework. The factor loadings are all positive. The variables there in are majorly serendipity, use of patent, curriculum review and entrepreneurship spirit. It means that these factors are to be considered to strike a balance between technology and entrepreneurship

FACTOR 3: ATTITUDINAL RATIO

Clu **sters 3(Factor 3): ATTITUDINAL RATIO**

S/N	Variable description	Factor loading
13	**Knowledge filter**	**0.659**
23	**Apoliticism**	**0.561**
27	**Push and Pull Factors**	**0.694**

Table 5

The third factors are a tripod involving knowledge filter apoliticism push and pull factors. Their factor loadings are middling which is suggesting that their role in entrepreneurship and technology is influential.

FACTOR 4: INNOVATION

Clusters 4(Factor 4): Innovation.		
S/N	**Variable description**	**Factor loading**
1	**Innovation**	**0.954**

Table 6

There is also a lone factor creatively labeled innovation. Innovation is works that delivers new goodness to new customers in new markets, and does it in a way that radically improves the probability equation. Its factor loading is very substantial. Innovation is a major driver of the economy.

FACTOR5: SELF APPRAISAL

	Clusters 5(Factor 5): Self-Appraisal	
S/N	**Variable description**	**Factor loading**
17	**Brainstorming**	**0.426**
24	**Knowledge diffusion**	**0.468**

Table 7

Now, we encounter a dual factor creatively labeled self-appraisal. It involves brainstorming and knowledge diffusion. An intending entrepreneur should brainstorm very well so as to come out with a product that has value and there should be diffusion of knowledge from successful entrepreneurs so as to improve on the technical knowhow of businesses.

4. CONCLUSION

Taken together, it can be concluded that the major factor that can be said to be the intersection between technology and entrepreneurship is Innovation which has the highest factor loading of 0.954. Accordingly, R&D is an integral part of innovation is a major driver of the economy. With grim determination and resoluteness, innovation charts a course. Essential ingredients of innovation include Ideation, idea execution, addressing a real challenge, adding value both for the innovator and end-user. It is so because innovation is always forward looking which is the hallmark of the intersection between technology and entrepreneurship.

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